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By Hand

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Room 222
Washington, D.C. 20544

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

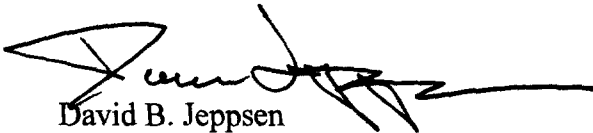
Re: GN Dkt. 96-228/Wireless Communications Services

Dear Mr. Caton:

This is to notify the Commission of an *ex parte* presentation to the Office of Engineering and Technology in the above referenced proceeding. The substance of the presentation is reflected in the attached technical statement.

Please call me should there be any questions.

Very truly yours,

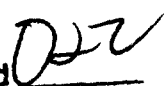


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Technical Statement of Lucent Technologies Inc.

**Amendment of the Commission's Rules to Establish Part 27,
the Wireless Communications Service ("WCS")
GN Docket No. 96-228**

January 8, 1997

Lucent Technologies is a leading supplier of wireless equipment and technology, and therefore our interests are congruent with the stated objectives of the pending spectrum auction. However, Lucent Technologies is concerned about the stringent emissions requirements being proposed for equipment operating in the 2.3 GHz band. In particular, the limits being proposed for fixed applications are virtually unprecedented throughout the wireless industry. They will substantially increase the cost of fixed wireless systems, thereby deterring the deployment of these types of applications.

Indeed, the record in this proceeding suggests that high-speed data applications are the most plausible type of applications that will be offered in this band. However, these type of systems would be adversely affected by the specifications. Since the specifications are so stringent, they will disadvantage wideband solutions necessary for high-speed data, including Internet, applications.

There is a delicate balance between emissions requirements to prevent inter-system interference, and the effect those requirements have on the cost, size, and complexity of communications systems. The cost of subscriber units in commercial wireless systems is of particular concern, since this drives the overall cost of the service to customers, and determines the customer's ability to afford such services. We present the problem from the two perspectives as follows.

Equipment Complexity and Cost Perspective

The effect of emissions specifications has a marked effect on many aspects of communications systems. Those systems which are intended to be inexpensive, and available to the general public are most affected by stringent emissions requirements. Therefore, it is most important that sufficient, but not overly-conservative requirements are prescribed. The effect of various levels of requirements on base station filter size and cost are presented in Table 1. Comparing the first and second rows, it is evident that the difference between an emissions specification of $70+10\log(P)$ and $43+10\log(P)$ causes a significant difference in the size and cost of the filters. The third row shows what we believe to be achievable in the near future using advances in filter technology and improved power amplifiers. With specifications on the order of $70+10\log(P)$, future gains will not be as dramatic, since different filter technology is necessary for the more stringent requirement.

Table 1. Effect of Emissions Specifications on Base Station Filter Cost

Emissions Specification (dBc/MHz)	Filter Q Required	Approximate Size	Price Range
$70+10\log(P)$	10,000 - 20,000	12" x 12" x 2"	\$250 - \$500
$43+10\log(P)$	3,000 - 4,000	2" x 4" x 1"	\$100 - \$200
$43+10\log(P)$	1,000 - 2,000	1mm x 1mm x 1/2mm	\$1 - \$2

The impact due to the more stringent emissions specifications on subscriber units is even more significant. The $43+10\log(P)$ specification can be met without special filtering, and therefore there is essentially no filter cost. This makes the production of relatively low cost, affordable subscriber terminals feasible. With higher out-of-band emission specifications, filtering would be required and thus raising the cost of the subscriber unit. However, in order to comply to the more stringent specification of $70+10\log(P)$ without a sufficiently wide guard band, a very high Q filter with such a sharp roll-off becomes a tremendous design challenge. A technically feasible, though almost equally undesirable solution would be to improve the power amplifier performance. The $70+10\log(P)$ out-of-band emissions requirement translates to a -40dBm requirement at the band edge and thus requiring the amplifier IP3 or 1 dB compression point be increased by as much as 10 dB. Thus a 10 to 20 watt power amplifier instead of a 2 watt amplifier required for such a low power subscriber terminal would be needed. This would drive the additional power requirement by 10 dB and increase the cost by 10 to 30 folds. For the more typical medium power applications, where power output on the order of 200mW is required, subscriber unit cost increase would be as significant as 100 folds.

Therefore, based on the perspective of equipment complexity and cost, the Commission should reduce the emissions specifications currently proposed for fixed applications to be consistent with the $43+10\log(P)$ requirement proposed for mobile applications.. Without this reduction, equipment will simply be too costly to make the spectrum allocation valuable to the wireless industry, particularly for wireless data applications.

Interference Between Systems

In their technical comments, Primosphere Limited Partnership advocates making the emissions specifications even more stringent. Based on our analysis and experience, Lucent Technologies is of the opinion that their analysis addresses very worst case conditions, and that some of the assumptions are overly conservative. In addition, the SDARS receiver noise characteristics was not realistic in their analysis.

Primosphere Limited Partnership stated that the SDARS receiver Noise Temperature was 200.0 °K. This resulted in a system Noise Energy of -145.6 dBW/MHz. However, without an expensive sophisticated cooling mechanism, the Noise Temperature for any receiver RF front end must exceed the ambient Thermal Noise Temperature of 290 °K. Assuming the SDARS receiver has a reasonably good LNA and with the receiver RF front end Noise Figure accounted for, a more realistic assumption for the SDARS Noise Temperature is at least 2,000. °K, which yields a good 10 dB higher noise energy than that previously computed by Primosphere. In addition, Primosphere allotted 0.2 dB increase in Noise Energy which is almost un-measurable. We believe a more reasonable assumption should be 2 dB.

Primosphere assumed a 10dBW/MHz of EIRP for the Fixed Wireless system (FWS). This value is relatively low compared to a realistic FWS Base Station, and yet much too high for a subscriber's terminal. Further, in their analysis, no cable loss, antenna polarization loss, nor any antenna pattern roll-off due to the use of highly directive antenna typically used for the FWS were accounted for.

Lucent Technologies also performed an in-depth interference analysis using an approach similar to that performed by the Primosphere. This analysis shows that the proposed FCC limits are more than adequate, and indeed are more stringent than what is needed for fixed applications. Based on our analysis, the FWS subscribers terminal having sufficiently low EIRP and the antenna being highly directive, thus the $43+10\log(P)$ out-of-band emissions specifications would be adequate to prevent excessive interference into the SDARS receiver. As far as the FWS base station interference into the SDARS receiver, our results concluded that, other than a few extraneously worst cases, the interference energy is sufficiently low that the $43+10\log(P)$ out-of-band emissions specifications should suffice. In those few cases where interference may occur, the Commission can alleviate any harmful effects of possible interference by requiring WCS/FWS and SDARS licensees to mutually cooperate with each other and to, where appropriate and reasonable, implement interference avoidance techniques, such as antenna position, antenna directionality, or extra filtering. The Commission has resolved competing

uses of spectrum through a similar approach in other areas, see, e.g. Local Multipoint Distribution Service and Fixed Satellite Services, Report and Order and Fourth Notice of Proposed Rulemaking, FCC 96-311 (rel. July 22, 1996), and there is no reason why the same principle cannot be followed here. In short, there is no basis for imposing the unrealistic emission requirements proposed by Primosphere, and the $43+10\log(P)$ requirement should be adequate for both fixed and mobile WCS systems..

As an alternative, the Commission can consider differentiating between the forward and reverse link of WCS systems. Our analysis concluded that interference will become a problem on the forward link, before it becomes a problem on the reverse link. Since the reverse link emissions requirement affects system cost most significantly, the Commission could set more lenient specifications on the reverse link and impose a slightly more restrictive requirement for the forward link.

Specifically, the Commission could impose an emissions specification on the order of $60+10\log(P)$ on the forward link (this is in line with Cellular in-band standards), and $43+10\log(P)$ on the reverse link. Such specifications would greatly reduce the cost of wireless systems for this band, but would continue to ensure the manageability of inter-system interference. By taking such steps, the Commission would in turn increase the appeal and value of the 2.3GHz spectrum.

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